REMARKS

Claims 1, 2, 17, 18, and 25-39 are currently pending and are under examination. Claims 1, 2, 17, 18, 28, 29, 32, and 33 have been amended to more clearly set forth aspects of the invention. Accordingly, claims 1, 2, 17, 18, 28, 29, 32, and 33, as amended, and dependent claims therefrom are under consideration.

Support for the amendments to the claims is found throughout the specification and in the original claims. Specifically, support for amendment to claims 1 and 2 is presented in original claims 1 and 2 and in the specification, for example, at page 4, lines 1-14. Support for amendment for claims 17 and 18 is presented in original claims 17 and 18 and in the specification, for example, at page 4, lines 1-18, wherein therapeutic applications for the cyclic peptides are described; at page 11, lines 5-11, wherein the terms "effective amount", "clinically significant reduction in *S. aureus* infection", and methods for administering, including: cutaneously, subcutaneously, intravenously, parenterally, orally, topically, or by aerosol are described. Support for amendment for claims 28 and 29 is found in original claims 17 and 18 and in the Examples presented in the specification, beginning at page 15, line 3. Claims 32 and 33 have been amended to correct typographical errors recited therein. No issue of new matter is introduced by these amendments.

Rejections under 35 USC § 112

Claims 17, 18, and dependent claims therefrom, have been rejected under 35 USC § 112, first paragraph, as allegedly containing subject matter which was not enabled by the specification. In view of applicants' arguments hereinbelow, this rejection is respectfully traversed.

Applicants respectfully direct the Examiner to the reference by Mayville et al. (1999, PNAS 96:1218-23) which was submitted for the Examiner's consideration in the Information Disclosure Statement filed on February 28, 2002 (IDS reference CU). As is evident from this publication, the present inventors have clearly demonstrated that the claimed peptide and variants thereof are effective agents for the therapeutic treatment of an *S. aureus* infection in a subject. See Mayville et al., Figures 3A-D and Figure legend thereto on page 1221 and additional commentary on, for example, page 1220, right

column, second paragraph. As described in the Mayville et al. reference, the subject to whom the cyclic peptide of the invention is administered and for whom therapeutic benefits are conferred is a mouse. Specifically, the *in vivo* model system involves inhibition of staphylococcal skin abscess formation by the claimed cyclic peptide following subcutaneous injection of *S. aureus* into the flank area of a hairless mouse. A skilled practitioner would be aware that skin abscesses are considered one of the "classic" conditions associated with a Staphylococcal infection and, therefore, would recognize that the "*in vivo* mouse protection test" described in the Mayville et al. reference (see Materials and Methods section at page 1220, left column, third paragraph) is a model system for skin abscesses in any mammal that are caused by a Staphylococcal infection.

Based on these published results, one of skill in the art would recognize that the claimed cyclic peptide would confer therapeutic benefit to a subject afflicted with a condition caused by an *S. aureus* infection, such as, for example, a skin abscess. Moreover, in that *S. aureus* is known to be one of the most prevalent causative agents of diagnosed bacterial infections, a skilled practitioner would be profoundly aware of the need for such novel peptides for intervening in the progression of an *S. aureus* infection from a clinically trivial condition (such as a localized skin infection) to a life threatening disease state (such as a systemic infection). Diseases associated with Staphylococcal infection are well known in the art and lists of such diseases are readily accessible to the public by a variety of dissemination means such as, for example, encyclopedias/dictionaries, textbooks, and electronic databases. Information pertaining to diseases associated with Staphylococcal infection can be accessed from various electronic databases by using predictable keywords such as "Staphylococcal infection". See articles attached hereto (authored by Thomas Herchline, MD or Maureen Haggerty) which were identified on a publicly accessible electronic database using these simple search words. Lists of Staphylococcal infection-related conditions are presented in each of these articles and include, for example: bacteremia, staphylococcal toxic shock syndrome, skin infections (folliculitis, furuncles, bullous impetigo, wound infections, and scalded skin syndrome), soft tissue infections (pyomyositis, septic bursitis, septic arthritis), toxic shock syndrome (TSS), endocarditis, osteomyelitis, pneumonia, food poisoning, prosthetic infections, and urinary tract infection (UTI). Based on the

availability of such information to the general public and numerous articles published in magazines and newspapers relating to the prevalence of Staphylococcal infections (particularly antibiotic resistant variants), applicants assert that an ordinarily skilled practitioner and an average layperson would be or could readily be made aware of conditions caused by Staphylococcal infection.

In view of general knowledge and arguments presented herein above, applicants assert that the claims, as presently amended, are enabled by the specification. Accordingly, applicants respectfully request that the rejection of claims 17, 18, and dependent claims therefrom, under 35 USC § 112, first paragraph, be withdrawn.

Claims 1, 2, 17, 18, and 25-37 have been rejected under 35 USC § 112, second paragraph, for alleged indefiniteness. Specifically, claims 1 and 2, and dependent claims therefrom, are allegedly indefinite for recitation of "synthetic amino acid" and "biosynthetic amino acid", which the Examiner maintains are unclear. Applicants respectfully disagree and direct the Examiner to the passages of the specification indicated hereinafter. At page 13, lines 8-10, a "synthetic amino acid" is defined as an amino acid which is chemically synthesized and is not one of the 20 amino acids naturally occurring in nature. At page 13, lines 11-13, a "biosynthetic amino acid" is referred to as an amino acid found in nature other than the 20 amino acids commonly described and understood in the art as "natural amino acids." In view of the support presented in the specification for the terms "synthetic amino acid" and "biosynthetic amino acid", the rejection of claims 1, 2, 17, 18, and 25-37 under 35 USC § 112, second paragraph, for alleged indefiniteness is respectfully traversed.

Claims 1 and 2, and dependent claims therefrom, have been rejected under 35 USC § 112, second paragraph, as allegedly indefinite for recitation of "capable". Although applicants respectfully disagree with the Examiner in this regard, claims 1 and 2 are amended herein to delete the word "capable", so as to expedite prosecution of the present claims to allowance. In view of this amendment, the rejection of 1 and 2, and dependent claims therefrom, under 35 USC § 112, second paragraph, for alleged indefiniteness is respectfully traversed.

Claims 1, 2, 28, and 29 have been rejected under 35 USC § 112, second paragraph, as allegedly indefinite for not indicating the term for which the acronym "agr"

refers. Applicants assert that this is a standard term in the art and an ordinarily skilled artisan would be familiar with the acronym. In the interests of expediting prosecution, however, claims 1 and 2 are amended herein to include the full terminology, namely "accessory gene regulator", for which "agr" is an acronym.

Claims 17 and 18 have been rejected under 35 USC § 112, second paragraph, as allegedly indefinite for not reciting the term for which the abbreviation "*S. aureus*" stands. Although abbreviations for species names are standard practice in the art and are immediately identifiable by a minimally skilled practitioner, claims 17 and 18 are amended herein to recite the entire species designation, "*Staphylococcus aureus*", for which *S. aureus* is an abbreviation.

Claims 32 and 33 have been rejected under 35 USC § 112, second paragraph, as allegedly indefinite for the presence of extra periods. Accordingly, claims 32 and 33 are amended herein to remove the indicated extra periods.

Claims 17, 25, 28, 30, 32, 34, and 36 have been rejected under 35 USC § 112, second paragraph, as indefinite for allegedly omitting essential steps. Claim 17, and dependent claims therefrom, have been amended to clarify the steps involved in the claimed method. Specifically, the sites and methods of administration, dosage parameters, and a step whereby the desired outcome for the effective treatment are indicated.

Applicants assert that an ordinarily skilled artisan would be able to choose the site and method for administering a cyclic peptide of the invention based on the *S. aureus* associated-condition to be treated. A medical practitioner would treat an abscess, for example, caused by an *S. aureus* infection in a localized manner by direct application of the cyclic peptide into the abscess. As indicated in the specification "an effective amount is the amount required to achieve a clinically significant reduction in said *S. aureus* infection" which ranges from at least a 30 percent to at least a 90 percent reduction in the infection. An ordinarily skilled practitioner is aware of a variety of assays whereby bacterial load or the number of bacteria in a subject can be measured directly (e.g., by isolating a sample from an abscess and counting bacterial cells in the sample) or assessed clinically (e.g., by examining a wound to determine if swelling, pus accumulation, localized elevated temperature, or pain levels are reduced). For *S. aureus* infections that

cause more systemic responses, a skilled practitioner would assess a reduction in bacterial load by performing standard procedures, such as taking the subject's temperature or assaying white blood cell count (elevation of either of which can be indicative of a bacterial infection), or culturing a blood sample isolated from an infected subject under conditions favorable to the growth of *S. aureus*. All of the above-mentioned assays and assessments are well within the capabilities of a minimally trained health practitioner. The timing for such determinations can be gauged by an attending physician based on the severity of the *S. aureus* associated-condition to be treated, the status of the patient, and the physician's professional experience dealing with similar infections.

Claims 18, 26, 27, 29, 31, 33, 35, and 37 have been rejected under 35 USC § 112, second paragraph, as indefinite for allegedly omitting essential steps. Claim 18, and dependent claims therefrom, have been amended to clarify the steps involved in the claimed method. Specifically, the sites and methods of administration, dosage parameters, and a step whereby the desired outcome for the effective treatment are indicated in amended claim 18 as described herein above in detail with regard to amended claim 17. The arguments presented herein above with respect to aspects of claim 17 are equally well applied to claim 18.

In view of the above arguments, the Examiner is respectfully requested to reconsider the rejections of the instant claims under 35 U.S.C. §112, second paragraph, and withdraw the rejections.

Rejections under the judicially created doctrine of obviousness-type double patenting

The Examiner has rejected claims 1, 2, 38, and 39 under the judicially created doctrine of obviousness-type double patenting as allegedly unpatentable over claims 1, 2, 13, and 14 of U.S. Patent No. 6,337,385. A Terminal Disclaimer is attached hereto, the filing of which is believed to overcome the above rejection of claims 1, 2, 38, and 39 of the present invention under the judicially created doctrine of obviousness-type double patenting.

Fees

No additional fees are believed to be necessitated by this amendment. However, should this be an error, authorization is hereby given to charge Deposit Account No. 11-1153 for any underpayment or to credit any overpayment.

Conclusion

It is submitted, therefore, that the claims are in condition for allowance. No new matter has been introduced. Allowance of all claims at an early date is solicited. In the event that there are any questions concerning this amendment, or application in general, the Examiner is respectfully urged to telephone the undersigned so that prosecution of this application may be expedited.

Respectfully submitted,

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June 18, 2004

Enclosures: Terminal Disclaimer
Article entitled "Staphylococcal Infections" by Thomas Herchline, MD
Article entitled "Staphylococcal infections" by Maureen Haggerty

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Staphylococcal Infections

Last Updated: November 15, 2002

Synonyms and related keywords: staphylococci, *Staphylococcus aureus, S aureus,* gram-positive cocci, *S aureus* bacteremia, staphylococcal toxic shock syndrome, *Staphylococcus epidermis, S epidermis,* staph infection, skin infections, folliculitis, furuncles, bullous impetigo, wound infections, scalded skin syndrome, soft tissue infections, pyomyositis, septic bursitis, septic arthritis, toxic shock syndrome, TSS, endocarditis, osteomyelitis, pneumonia, food poisoning, prosthetic infections, coagulase-negative staphylococci, urinary tract infection, UTI, neutropenia, neutrophil dysfunction, diabetes, intravenous drug abuse, foreign bodies, trauma

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AUTHOR INFORMATION

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INTRODUCTION

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Background: Most infections caused by staphylococci are due to *Staphylococcus aureus*. However, the incidence of infections due to *Staphylococcus epidermidis* and

Related Articles

Brain Abscess
Cellulitis
Decubitus Ulcers
Diabetic Ulcers
Human Bite Infections
Impetigo
Influenza
Liver Abscess
Myocardial Abscess
Nongonococcal Infectious Arthritis
Perianal Abscess
Perinephric Abscess

other coagulase-negative staphylococci has been steadily increasing in recent years. This article focuses on *S aureus,* with occasional comments about the coagulase-negative staphylococci when important differences exist.

Pathophysiology: *S aureus* is a gram-positive coccus that is catalase-positive and coagulase-positive. Colonies are golden and strongly hemolytic on blood agar. They produce a range of toxins, including alpha-toxin, beta-toxin, gamma-toxin, delta-toxin, leukocidin, exfoliatin, enterotoxins, and toxic shock syndrome toxin-1. Coagulase-negative staphylococci, particularly *S epidermidis,* produce an exopolysaccharide (slime) that promotes foreign body adherence and resistance to phagocytosis.

Frequency:

- **In the US:** As many as 80% of individuals are colonized with *S aureus* at some point. Most are colonized only intermittently; 20-30% are colonized persistently. Health care workers, persons with diabetes, and patients on dialysis all have higher rates of colonization. The anterior nares are the predominant site of colonization in adults; other potential sites of colonization include the axilla, rectum, and perineum.

Mortality/Morbidity: Mortality from staphylococcal infections varies widely. Untreated *S aureus* bacteremia has a mortality rate exceeding 80%. The mortality rate for staphylococcal toxic shock syndrome is 3-5%. Infections due to coagulase-negative staphylococci usually have a very low mortality rate. Because these infections are commonly associated with prosthetic devices, the most serious complication is the need to remove the involved prosthesis, although prosthetic valve endocarditis might result in significant mortality.

Race: No association is reported with staphylococci infections and race.

Sex: The vaginal carriage rate is approximately 10% in premenopausal women. The rate is even higher during menses.

Age: Many neonates become colonized on the skin, perineum, umbilical stump, and GI tract. The adult colonization rate is approximately 40% at any given time.

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History: Common manifestations of staphylococci infections include the following types of infections. The history obtained usually depends on the type of infection the organism causes.

- Skin infections
  - Folliculitis
  - Furuncles

Pneumococcal Infections

Pneumonia, Bacterial

Septic Shock

Spinal Cord Abscess

Splenic Abscess

Streptococcus Group A Infections

Streptococcus Group B Infections

Toxic Shock Syndrome

Urinary Tract Infection, Females

Wound Infection

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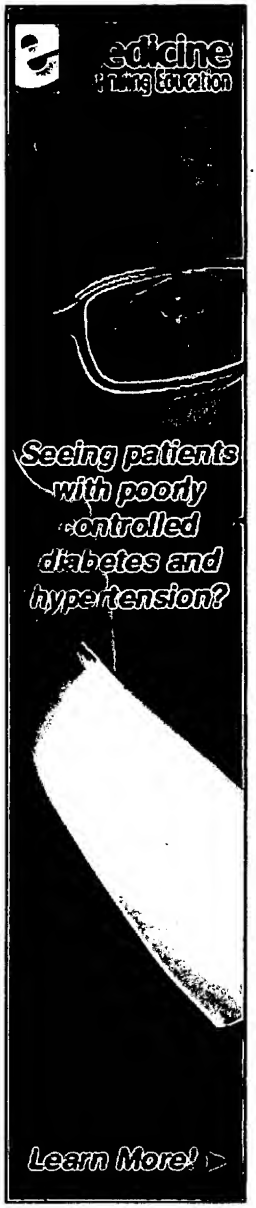

- Impetigo (bullous)
- Wound infections
- Scalded skin syndrome

- Soft tissue infections (pyomyositis, septic bursitis, septic arthritis)
- Toxic shock syndrome
- Endocarditis
- Osteomyelitis
- Pneumonia
- Food poisoning
- Infections related to prosthetic devices
  - Commonly associated with coagulase-negative staphylococci
  - Includes prosthetic joints and heart valves and vascular shunts, grafts, and catheters
- Urinary tract infection

Physical:

- Skin and soft tissue infections
  - Erythema
  - Warmth
  - Draining sinus tracts
  - Superficial abscesses
  - Bullous impetigo
- Toxic shock syndrome
  - Fever greater than 38.9°C
  - Diffuse erythroderma - Deep, red, "sunburned" appearance
  - Hypotension

- Desquamation - Occurs 7-14 days after onset of illness, most commonly involves palms and soles

- Endocarditis
  - Regurgitant murmur
  - Petechiae or other cutaneous lesions (see Images 1-2)
  - Fever

Causes: Predisposing factors for staphylococci infections include the following:

- Neutropenia or neutrophil dysfunction
- Diabetes
- Intravenous drug abuse
- Foreign bodies, including intravascular catheters
- Trauma

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Brain Abscess
Cellulitis
Decubitus Ulcers
Diabetic Ulcers
Human Bite Infections
Impetigo
Influenza
Liver Abscess
Myocardial Abscess
Nongonococcal Infectious Arthritis
Perianal Abscess
Perinephric Abscess
Pneumococcal Infections
Pneumonia, Bacterial
Septic Shock
Spinal Cord Abscess
Splenic Abscess
Streptococcus Group A Infections
Streptococcus Group B Infections
Toxic Shock Syndrome
Urinary Tract Infection, Females
Wound Infection

Other Problems to be Considered:

Animal bites
Epidural abscess
Epiglottitis
Osteomyelitis
Septic arthritis

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Lab Studies:

- Obtain cultures (with susceptibilities) as appropriate for the site of infection. Blood culture results may be positive even when results from other cultures are negative. Obtain blood cultures from all patients with serious infections.
- CBC count reveals that most patients have leukocytosis with a left shift (bands). Patients may have thrombocytosis in chronic infection.

Other Tests:

- If transthoracic echocardiography findings are inconclusive or the study is contraindicated, obtain transesophageal echocardiography (TEE) for the above situations.
- TEE is recommended for all patients with catheter-related *S aureus* bacteremia (and no contraindications). Perform TEE in patients with *S aureus* bacteremia and no clear source of infection.

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Medical Care: Promptly start antimicrobial therapy when *S aureus* infection is suggested or documented. Abscesses must be drained. Often, infections (particularly coagulase-negative staphylococci) require removal of a foreign body.

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Numerous antibiotics have good activity against *S aureus*. However, isolates resistant to methicillin are typically resistant to most agents other than vancomycin. As such, initially start patients with serious staphylococcal infections on vancomycin until susceptibility results are available. Many coagulase-negative staphylococci are resistant to all antimicrobials other than vancomycin. The duration of treatment and the use of synergistic combinations depend on the type of infection encountered. Endocarditis due to *S aureus* usually requires synergistic therapy at first and then prolonged courses of parenteral antibiotics.

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Staphylococcal infections

Definition

Staphylococcal (staph) infections are communicable conditions caused by certain bacteria and generally characterized by the formation of abscesses. They are the leading cause of primary infections originating in hospitals (nosocomial infections) in the United States.

Description

Classified since the early twentieth century as among the deadliest of all disease-causing organisms, staph exists on the skin or inside the nostrils of 20-30% of healthy people. It is sometimes found in breast tissue, the mouth, and the genital, urinary, and upper respiratory tracts.

Although staph bacteria are usually harmless, when injury or a break in the skin enables the organisms to invade the body and overcome the body's natural defenses, consequences can range from minor discomfort to **death**. Infection is most apt to occur in:

- newborns
- women who are breastfeeding
- individuals whose immune systems have been undermined by radiation treatments, **chemotherapy**, or medication
- intravenous drug users
- those with surgical incisions, skin disorders, and serious illness like **cancer**, diabetes, and lung disease

Types of infections

Staph infections produce pus-filled pockets (abscesses) located just beneath the surface of the skin or deep within the body. Risk of infection is greatest among the very young and the very old.

A localized staph infection is confined to a ring of dead and dying white blood cells and bacteria. The skin above it feels warm to the touch. Most of these abscesses eventually burst, and pus that leaks onto the skin can cause new infections.

A small fraction of localized staph infections enter the bloodstream and spread through the body. In children, these systemic (affecting the whole body) or disseminated infections frequently affect the ends of the long bones of the arms or legs, causing a bone infection called **osteomyelitis**. When adults develop invasive staph infections, bacteria are most apt to cause abscesses of the brain, heart, kidneys, liver, lungs, or spleen.

Staphylococcus aureus

Named for the golden color of the bacteria grown under laboratory conditions, *S. aureus* is a hardy organism that can survive in extreme temperatures or other inhospitable circumstances. About 70-90% of the population carry this strain of staph in the nostrils at some time. Although present on the skin of only 5-20% of healthy people, as many as 40% carry it elsewhere, such as in the throat, vagina, or rectum, for varying periods of time, from hours to years, without developing symptoms or becoming ill.

S. aureus flourishes in hospitals, where it infects healthcare personnel and patients who have had surgery; who have acute **dermatitis**, insulin-dependent diabetes, or dialysis-dependent kidney disease; or who receive frequent allergy-desensitization injections. Staph bacteria can also contaminate bedclothes, catheters, and other objects.

S. aureus causes a variety of infections. **Boils** and inflammation of the skin surrounding a hair shaft (**folliculitis**) are the most common. Toxic shock (TSS) and scalded skin syndrome (SSSS) are among the most serious.

TOXIC SHOCK

Toxic shock syndrome is a life-threatening infection characterized by severe **headache**, **sore throat**, **fever** as high as 105°F, and a sunburn-like rash that spreads from the face to the rest of the body. Symptoms appear suddenly; they also include **dehydration** and watery **diarrhea**.

Inadequate blood flow to peripheral parts of the body (shock) and loss of consciousness occur within the first 48 hours. Between the third and seventh day of illness, skin peels from the palms of the hands, soles of the feet, and other parts of the body. Kidney, liver, and muscle damage often occur.

SCALDED SKIN SYNDROME

Rare in adults and most common in newborns and other children under the age of five, scalded skin syndrome originates with a localized skin infection. A mild fever and/or an increase in the number of infection-fighting white blood cells may occur.

A bright red rash spreads from the face to other parts of the body and eventually forms scales. Large, soft blisters develop at the site of infection and elsewhere. When they burst, they expose inflamed skin that looks as if it had been burned.

MISCELLANEOUS INFECTIONS

- Nurse
- Nutritionist
- Fitness Trainer

Message Boards

- Diabetes Type 1 Message Board
- Coronary Heart Disease Message Board
- Asthma Message Board

more...

Encyclopedia

- Condition A-Z

Fun Time

- E-Cards
- Life Clock

S. aureus can also cause:

- arthritis
- bacteria in the bloodstream (**bacteremia**)
- pockets of infection and pus under the skin (carbuncles)
- tissue inflammation that spreads below the skin, causing **pain** and swelling (cellulitis)
- inflammation of the valves and walls of the heart (**endocarditis**)
- inflammation of tissue that enclosed and protects the spinal cord and brain (**meningitis**)
- inflammation of bone and bone marrow (osteomyelitis)
- pneumonia

Other strains of staph

S. EPIDERMIDIS.

Capable of clinging to tubing (as in that used for intravenous feeding, etc.), prosthetic devices, and other non-living surfaces, *S. epidermidis* is the organism that most often contaminates devices that provide direct access to the bloodstream.

The primary cause of bacteremia in hospital patients, this strain of staph is most likely to infect cancer patients, whose immune systems have been compromised, and high-risk newborns receiving intravenous supplements.

S. epidermidis also accounts for two of every five cases of prosthetic valve endocarditis. Prosthetic valve endocarditis is endocarditis as a complication of the implantation of an artificial valve in the heart. Although contamination usually occurs during surgery, symptoms of infection may not become evident until a year after the operation. More than half of the patients who develop prosthetic valve endocarditis die.

STAPHYLOCOCCUS SAPROPHYTICUS

Existing within and around the tube-like structure that carries urine from the bladder (urethra) of about 5% of healthy males and females, *S. saprophyticus* is the second most common cause of unobstructed urinary tract infections (UTIs) in sexually active young women. This strain of staph is responsible for 10-20% of infections affecting healthy outpatients.

Causes and symptoms

Staph bacteria can spread through the air, but infection is almost always the result of direct contact with open sores or body fluids contaminated by these organisms.

Staph bacteria often enter the body through inflamed hair follicles or oil glands. Or they penetrate skin damaged by **burns**, cuts and scrapes, infection, insect bites, or **wounds**.

Multiplying beneath the skin, bacteria infect and destroy tissue in the area where they entered the body. Staph infection of the blood (staphylococcal bacteremia) develops when bacteria from a local infection infiltrate the lymph glands and bloodstream. These infections, which can usually be traced to contaminated catheters or intravenous devices, usually cause persistent high fever. They may cause shock. They also can cause death within a short time.

Warning signs

Common symptoms of staph infection include:

- pain or swelling around a cut, or an area of skin that has been scraped
- boils or other skin abscesses
- blistering, peeling, or scaling of the skin; this is most common in infants and young children
- enlarged lymph nodes in the neck, armpits, or groin

A family physician should be notified whenever:

- Lymph nodes in the neck, armpits, or groin become swollen or tender.
- An area of skin that has been cut or scraped becomes painful or swollen, feels hot, or produces pus. These symptoms may mean the infection has spread to the bloodstream.
- A boil or carbuncle appears on any part of the face or spine. Staph infections affecting these areas can spread to the brain or spinal cord.
- A boil becomes very sore. Usually a sign that infection has spread, this condition may be accompanied by fever, chills, and red streaks radiating from the site of the original infection.
- Boils that develop repeatedly. This type of recurrent infection could be a symptom of diabetes.

Diagnosis

Blood tests that show unusually high concentrations of white blood cells can suggest staph infection, but diagnosis is based on laboratory analysis of material removed from pus-filled sores, and on analysis of normally uninfected body fluids, such as, blood and urine. Also, x rays can enable doctors to locate internal abscesses and estimate the severity of infection. Needle biopsy (removing tissue with a needle, then examining it under a microscope) may be used to assess bone involvement.

Treatment

Superficial staph infections can generally be cured by keeping the area clean, using soaps that leave a germ-killing film on the skin, and applying warm, moist compresses to the affected area for 20-30 minutes three or four times a day.

Severe or recurrent infections may require a seven to 10 day course of treatment with penicillin or other oral **antibiotics**. The location of the infection and the identity of the causal bacteria determines which of several effective medications should be prescribed.

In case of a more serious infection, antibiotics may be administered intravenously for as long as six weeks. Intravenous antibiotics are also used to treat staph infections around the eyes or on other parts of the face.

Surgery may be required to drain or remove abscesses that form on internal organs, or on shunts or other devices implanted inside the body.

Alternative treatment

Alternative therapies for staph infection are meant to strengthen the immune system and prevent recurrences. Among the therapies believed to be helpful for the person with a staph infection are **yoga** (to stimulate the immune system and promote relaxation), **acupuncture** (to draw heat away from the infection), and herbal remedies. Herbs that may help the body overcome, or withstand, staph infection include:

- Garlic (*Allium sativum*). This herb is believed to have anitbacterial properties. Herbalists recommend consuming three garlic cloves or three garlic oil capsules a day, starting when symptoms of infection first appear.
- Cleavers (*Galium aparine*). This anti-inflammatory herb is believed to support the lymphatic system. It may be taken internally to help heal staph abscesses and reduce swelling of the lymph nodes. A cleavers compress can also be applied directly to a skin infection.
- Goldenseal (*Hydrastis canadensis*). Another herb believed to fight infection and reduce imflammation, goldenseal may be taken internally when symptoms of infection first appear. Skin infections can be treated by making a paste of water and powdered goldenseal root and applying it directly to the affected area. The preparation should be covered with a clean bandage and left in place overnight.
- Echinacea (*Echinacea* spp.). Taken internally, this herb is believed to have antibiotic properties and is also thought to strengthen the immune system.
- Thyme (*Thymus vulgaris*), lavender (*Lavandula officinalis*), or bergamot (*Citrus bergamot*) oils. These oils are believed to have antibacterial properties and may help to prevent the scarring that may result from skin infections. A few drops of

- these oils are added to water and then a compress soaked in the water is applied to the affected area.

- Tea tree oil (*Melaleuca* spp.). Another infection-fighting herb, this oil can be applied directly to a boil or other skin infection.

Prognosis

Most healthy people who develop staph infections recover fully within a short time. Others develop repeated infections. Some become seriously ill, requiring long-term therapy or emergency care. A small percentage die.

Prevention

Healthcare providers and patients should always wash their hands thoroughly with warm water and soap after treating a staph infection or touching an open wound or the pus it produces. Pus that oozes onto the skin from the site of an infection should be removed immediately. This affected area should then be cleansed with antiseptic or with antibacterial soap.

To prevent infection from spreading from one part of the body to another, it is important to shower rather than bathe during the healing process. Because staph infection is easily transmitted from one member of a household to others, towels, washcloths, and bed linens used by someone with a staph infection should not be used by anyone else. They should be changed daily until symptoms disappear, and laundered separately in hot water with bleach.

Children should frequently be reminded not to share:

- brushes, combs, or hair accessories
- caps
- clothing
- sleeping bags
- sports equipment
- other personal items

A diet rich in green, yellow, and orange vegetables can bolster natural immunity. A doctor or nutritionist may recommend **vitamins** or mineral supplements to compensate for specific dietary deficiencies. Drinking eight to 10 glasses of water a day can help flush disease-causing organisms from the body.

Because some strains of staph bacteria are known to contaminate artificial limbs, prosthetic devices implanted within the body, and tubes used to administer medication or drain fluids from the body, catheters and other devices should be removed on a regular basis, if possible, and examined for microscopic signs of staph. Symptoms may not become evident until many months after contamination has occurred, so this practice should be followed even with patients who

show no sign of infection.

Abscess
A cavity containing pus surrounded by inflamed tissue.

Endocarditis
Inflammation of the lining of the heart, and/or the heart valves, caused by infection.

Nosocomial infections
Infections that were not present before the patient came to a hospital, but were acquired by a patient while in the hospital.

For Your Information

Books

- Bennett, J. Claude, and Fred Plum, eds. Cecil Textbook of Medicine. Philadelphia: W. B. Saunders Co., 1996.
- Civetta, Joseph M., et al., eds. Critical Care. Philadelphia: Lippincott-Raven Publishers, 1997.
- Harrison's Principles of Internal Medicine. Ed. Anthony S. Fauci, et al. New York: McGraw-Hill, 1997.
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